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A History of the Ecological Sciences, Part 4. Roman Natural History

Roman natural history was a product of the first transfer of fully fledged science from one civilization to another. Rome's gradual conquest of the Greek states and empires, 200–30 BC, did not disrupt Greek science; if anything, it expanded its influence. However, just because Posidonios and other Greek professors had appreciative Roman students does not mean that Romans became scientists. Not enough of the cultural factors that favored Greek critical and abstract thinking were also present in Rome's culture. Romans had a practical mentality that found expression in government and engineering, although they could follow the Greeks into philosophy and literature. Educated Romans also appreciated the importance of Greek science, and therefore Romans wrote "Reader's Digest Condensed Versions" of it. Their interest in disseminating scientific information was commendable, but there were two drawbacks (Stahl 1962). First, Latin condensations contained only the findings, not the methodology, which meant that Romans learned neither how to do science nor how to evaluate it. However, Greek natural history never developed as sophisticated a methodology as did Greek astronomy, and there was not as much loss here as there was in the more mathematical sciences. Second, Romans valued the Latin condensations more highly than the Greek originals; consequently, some of the Greek originals were lost.

Five Roman agricultural treatises survive. They contain observations on the influence of environmental factors, such as soil fertility, moisture, crop pests, and animal parasites, on domesticated plants and animals (Glacken 1967, White 1970). A Greek precedent, Xenophon's *Oeconomicos*, on estate management, exerted some

influence on them. Marcus Porcius Cato (234–149 BC, known as "the Elder" to distinguish him from his grandson), a prominent Senator, wrote *De Agri Cultura*, briefest of the agricultural treatises and the earliest surviving prose work in Latin; its lack of organization raises the possibility that he had not finished it when he died. It provides examples of a plantation owner trying to cope with environmental problems, but its practical approach cannot be characterized plausibly as applied ecology. Yet it was a start, and later authors compared it with both their own experiences and with Theophrastean botanical works (Greene 1983).

Marcus Terentius Varro (116–27 BC), more than a century later, wrote *Res Rusticae*, which was over twice as long. Its elegant dialog form contrasts starkly with Cato's unpolished instructions. Varro was a diligent encyclopedist who only started writing on agriculture in his 80th year, yet this is the only one of his many writings to survive. Cato had discussed briefly oxen and sheep, but Varro devoted two-thirds of *Res Rusticae* to animals: from oxen to chickens to honey bees. After polite preliminaries, one of the assembled friends asked whether he considered agriculture an art, and Varro's spokesman replied: "It is not only an art butIt is, as well, a science, which teaches what crops are to be planted in each kind of soil, and what operations are to be carried on, in order that the land may regularly produce the largest crops" (I.iii.5–9; Hooper and Ash translation). However, this claim was more of a vision of what might be than what was. Varro's science occasionally rose above ordinary generalities and folklore, but not by much (I.vi.3–4): Those who live in the lowlands suffer more in summer; those who live in the uplands suffer more in the winter; the same crops are planted earlier in the spring in the lowlands than in the uplands, and are harvested earlier, whereas both sowing and reaping come later in the uplands. Certain trees, such as the fir

and the pine, flourish best and are sturdiest in the mountains on account of the cold climate, whereas the poplar and the willow thrive here [below] where the climate is warmer. . . . Varro drew upon personal experience with livestock in his account of the life history of sheep, and their transhumance between high summer grazing and low winter grazing is presented in some detail; it contains ecological details, but not generalizations (II.ii.7–20).

A younger contemporary, Publius Vergilius Maro (70–19 BC), was Rome's most beloved poet. His *Aenied* was inspired by Homer and became the national epic. Virgil undoubtedly felt close to his rural origins, but wrote his *Georgics* at the request of his patron, Maecenas. Nevertheless, Virgil's love of the countryside makes this one of the most popular writings on farming ever written. However, for technical details he depended heavily upon Varro (Royds 1914, Abbe 1965, Wilkinson 1969, McKay 1970).

The third Roman treatise, by Lucius Junius Moderatus Columella (fl. mid 1st century AD), is similarly titled *Res Rustica*, and is supplemented by his much briefer *De Arboribus*. Whereas Cato and Varro's writings together fit into one small volume, Columella's two works are in three volumes of the same size. He was from Gades (Cadiz) in Spain, and as a youth, he spent much time on an uncle's farm. As an adult, Columella owned several farms near Rome at various times. On the first page of *Res Rustica*, he explained that he wrote his treatise because people complained that "the soil was worn out and exhausted by the over-production of earlier days and can no longer furnish sustenance to mortals with its old-time benevolence," (*On Agriculture*, Ash translation). The problem was a lack of knowledge, and he wondered why there were schools to train men for other professions, but not for farming. He warned that anyone wishing to master the science of husbandry "must have a shrewd insight into the works of nature; he must not be ignorant of the variations of latitude,

that he may have ascertained what is suitable to every region and what is incompatible" (Preface, 22). This was no simple matter, because, for example: seasons can vary from year to year in the same place, being in some years hotter or wetter than in other years; judging the various soils was difficult; each breed of sheep required special handling; and there were many different methods of grafting and pruning trees and vines.

Columella was familiar with earlier agricultural writings, including many that have disappeared. Although he respected collective wisdom, he urged further experimentation and he judged their advice against his own experience, expressing disagreement as readily as agreement. Ancient science was not notably experimental, and Columella actually had in mind trial and error, which occasionally produced valid results. One example that he cited from the writings of Saserna was the fact that poor soil could be improved by growing what we call legumes (lupine, vetch, lentils, chickpea, and peas). Columella also provided information about the use of manure and urine to promote growth. His uncle Marcus Columella had improved gravelly ground by mixing in clay, and had improved clayey ground by mixing in gravel. Our author reported that crop rotation improved meadowland, but he did not emphasize this idea. He judged the quality of soils by the types of natural vegetation growing on it, but provided few details. He disagreed with Celsus's claim that all good soils are black or gray.

One-fifth of *Res Rustica* was devoted to growing and caring for grapevines. Although much of its advice is practical, some of it is merely folklore. There were ecological aspects of this endeavor; one needed to match particular varieties with their preferred weather and soil conditions, although the instructions for doing so are imprecise; the best soils are neither too compact nor too loose, neither poor nor rich, yet fertile, neither wet nor dry, but moderately moist; vines need warm, not cold weather. Book V reviewed the basics of mea-

suring land and then discussed the spacing of vines on a field of a given size. Columella was interested in knowing what spacing might yield the best volume of grapes, but he did not experiment to determine it. Nothing else was as much trouble as grape vines. Olive, fig, almond, pomegranate, and pear were easily cared for, but one needed to know what time of year to plant them, which he explained.

His discussion of livestock has interesting accounts of parasites, although there is little curiosity about causes (Hoepli 1959). Worms occur in calves that have indigestion; to get rid of them, administer wormwood ground up with dried figs and bitter-vetch. Tapeworms and maw-worms can harm the intestines of horses; to remove them, first insert one's (or a slave's?) hand into the intestine and remove the dung, wash out the bowel with salt water, then pour down their throats the roots of caper-trees ground up with vinegar. To get rid of flies on wounds, pour on the wound pitch and oil or fat. If livestock gets sick, move the flock to a different climate and divide it into smaller flocks, because the disease then will spread less. When a skin rash is discovered, treat it quickly or it will infect the whole flock. A tubercle in the skin that has a worm inside should be cut out, but take care not to injure the worm because its juices are poisonous and make the wound difficult to heal; drip burning fat on the wound. If sheep or pigs have lung disease, insert lungwort in the ears. Flies cause dog ears to develop sores; prevent it by rubbing the ears with crushed bitter almonds, but if the sores are already there, drip boiled pitch and lard on the wounds. Ticks fall off when touched with this preparation; do not pull ticks off because it causes a sore. There are various remedies for fleas.

Rutilius Taurus Aemilianus Palladius (300s AD) wrote the fourth manual, *Opus agriculturae*. He borrowed heavily from Columella, but drew also upon his own experience and the accumulation of information since Columella's time. His organization was seasonal rather than topical,

and there was little new of ecological significance. Palladius's organization of the information appealed to Italians and English more than a thousand years later when they became interested in agricultural improvements.

Aulus Cornelius Celsus (fl. 20s–30s AD) also wrote an encyclopedia, but only the medical sections survive. He told of medicines to expel intestinal round or flat worms, but did not speculate on their origin (IV.24; Hoespli 1959). The reason why more of Varro's and Celsus' encyclopedias did not survive is possibly because all of the *Naturalis historia* by Pliny the Elder does survive; manpower to make new copies of all three encyclopedias may not have been available in later centuries.

Gaius Plinius Secundus (c.23–79 AD) was a provincial from Novum Comum who, in his earlier years, served as an army officer and an administrator; he remained head of the western Roman fleet until his death (Reynolds 1986). In his later years, he was so devoted to literary researches that he had a secretary either read to him or take dictation during his bath, meals, and while traveling. Pliny died at Stabiae, on the Italian coast 9 miles from Mount Vesuvius during its eruption. His fleet was stationed near Naples, and he wanted to get close enough to study the eruption when he received an appeal to rescue people at Stabiae. The navy responded, but after landing, winds increased and the waves were too high for them to leave. The next morning, as they began leaving, Pliny fell dead while slaves helped him to his feet. Possibly he had a heart attack precipitated by volcanic dust (Zirkle 1967, Grmek 1987).

Pliny was a diligent compiler of information, and although he was less discriminating than authors at the Lyceum, they too had accepted some unreliable reports. He helped to make Greek learning available in Latin and he also used Roman information (Beagon 1992, French 1994:196–255). His accounts of plants (Greene 1983, Morton 1986) and animals (Cotte 1944, André 1956, Toynbee 1973,

Bodson 1986, Beavis 1988) contain a miscellany of ecological comments. For example, a description of a rodent plague contained some new information, but it mainly summarized an Aristotelian account, while confusing the facts (Egerton 1968). Nevertheless, he followed the Lyceum's belief that these plagues could be accounted for largely by knowledge of reproduction and climate. Pliny's account of locusts implies that means of controlling the species could be found in knowledge of its life history (Bodson 1991). Much of his information on parasites came from *Historia Animalium* (Hoespli 1959, Théodoridès 1966: 134).

Later authors, such as Claudius Aelianus (c.170–c.235), wrote natural histories less to inform than to entertain. Claudius was a Roman, but to display his erudition, he wrote *On the Characteristics of Animals* in Greek. He reported that south of the Caspian Sea, farmers were plagued by rats, and their main response was to protect rat predators, the birds of prey. In eastern Galatia, where locust plagues were common, people prayed and offered sacrifices to charm birds into eating locusts. Aelian's fish lore included this.

The Mullet is one of those fishes that live in pools and is believed to control its appetite and to lead a most temperate existence. For it never sets upon a living creature, but is naturally inclined to peaceful relations with all fish. If it comes across any dead fish, it makes its meal off that" (I.3, Schofield translation).

Especially entertaining were his stories of the relationships between species, including a somewhat detailed account of the cuckoo's brood parasitism (III.30; Bodson 1982). Treatises on agriculture and natural history are not good sources for biological theory, but Roman writings on philosophy sometimes have scientific implications, if not theory.

Marcus Tullius Cicero (106–43 BC) was one of the few men in history who were both leading statesmen and leading authors. His *De Natura Deorum* was the most important synthesis of providential ecology, or the balance of nature, from antiquity (Egerton 1973). He had studied under Posidonios and was probably indebted to him for both his own interest in, and knowledge of, science. Because Posidonios' writings do not survive, we can only guess at Cicero's indebtedness to him. Cicero also used ideas from Herodotos and Plato: the balance of nature is maintained by the existence of differential rates of reproduction, a different place in nature for each species, physical traits for each species that guarantee survival of the species, and mutual relationships between certain species.

No Roman achieved a scientific synthesis in natural history. However, the influence of their natural history writings was far from negligible. During the Middle Ages and Renaissance, Roman natural history writings were valued almost as highly as Greek writings.

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